BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of	)	
	)	
Preparation for International Telecommunication Union World Radiocommunication Conference	)	IC Docket No. 94-31

To: The Commission:

REPLY COMMENTS OF
Leo One USA CORPORATION

Leo One USA Corporation ("Leo One USA"), by counsel, hereby submits its Reply Comments in the Commission's Second Notice of Inquiry ("Notice") regarding preparations for the International Telecommunications Union ("ITU") World Radiocommunication Conference ("WRC-95") to be held in Geneva, Switzerland in October/November 1995. In this reply, Leo One USA reiterates the necessity for WRC-95 to allocate frequency to the Non-voice, Non-geostationary Mobile Satellite Service ("NVNG MSS"), provides detailed information on the ability of the NVNG MSS to share with existing services and offers several suggestions for possible frequency allocations.

I. It Is Imperative That WRC-95 Allocate Frequency To The NVNG-MSS

In its initial comments, Leo One USA outlined the reasons that it was necessary for WRC-95 to allocate frequency to the NVNG MSS. Specifically, Leo One USA concurred with the conclusion of Task Group 8/3 ("TG 8/3") that there is a requirement for an additional allocation of at least 10 MHz for the NVNG MSS in order to meet projected service demand in the year 2000. This conclusion was not questioned at all in the comments to the Second NOI in this proceeding. More importantly, the recently completed Conference Preparatory Meeting ("CPM") also concurred in this conclusion. Specifically, the CPM Report states:

> Projections, by MSS system developers and others, are for about 6 million users by the year 2000. Given the time required to develop and construct satellite systems, to meet the MSS requirements below 1 GHz, a range of an additional 7 to 10 MHz will be required in the near future.[1]

Thus, it is clear that a requirement exists for an additional allocation of frequency of approximately 7 to 10 MHz for the NVNG MSS and, in order for this requirement to be met, the allocation must be made at WRC-95. This conclusion is supported by TG 8/3, the comments in this proceeding and the CPM.

Leo One USA believes that failure of WRC-95 to make the allocation will not be in the interest of potential users of this new dynamic telecommunication service, the emerging NVNG MSS industry and the United States. If there is no allocation, potential users will be forced to use less efficient telecommunications services or obtain NVNG MSS services from a monopoly or duopoly provider. This will certainly not promote the provision of economic and innovative telecommunication services. Relatedly, if there is no allocation, it will limit the ability of new telecommunication service providers and hardware manufacturers (satellite, gateway and transceivers) to develop and support this service. Finally, the lack of an allocation at WRC-95 will inhibit the United States' interest in developing export industries and promoting the Global Information Infrastructure ("GII"). This is because it will be extremely difficult for any new United

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[1] See CPM Report at 69.

States NVNG MSS systems to emerge. For all of these reasons, Leo One USA urges the United States to propose to WRC-95 specific allocations for the NVNG MSS.

II. NVNG MSS Can Effectively Share With Other Services

During the last several years, significant analysis has been undertaken that concluded that NVNG MSS[2] systems could share with other users. The recently completed CPM concluded that:

> Sharing between the MSS and terrestrial fixed and mobile systems, in the uplink direction, in the 148-149.9 MHz band can be accomplished by designing the MSS systems to operate in either a narrow-band, frequency-agile fashion to coexist with terrestrial services or with wideband, low-power density, spread-spectrum transmissions which will provide sufficient margin against interference. Both of these transmission techniques reduce the possibility of interference to systems that share the same spectrum. In addition, the nature of the data-only services provided by MSS systems and the markets served by them are amenable to incorporation of other interference reduction techniques such as short, sub-second data bursts and low-duty-cycle transmissions. The mobility of the users may reduce the coupling that can occur between the MSS system and other band occupants.
>
> Sharing with other space systems in the space-to-Earth direction is accomplished by means of low-power density, orthogonally-polarized, spread-spectrum downlinks or co-channel avoidance. Coordination among planned or existing frequency assignments for MSS systems and METSAT/EES systems usually will be needed; this has the benefit of ensuring compatibility on a case-by-case basis. The coordination can be conducted via bilateral negotiations between affected administrations.

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[2] See ITU-R M.1039 (Method for Evaluating Sharing Between Stations in the Mobile Service Below 1 GHz and FDMA Non-Geostationary Satellite Orbit (Non-ISO) Mobile Earth Stations) and Recommendation ITU-R M.1087 (Method for Evaluating sharing Between Systems in the Land Mobile Service and Spread Spectrum Leo Systems in the MSS Below 1 GHz).

Some of the initial comments in this proceeding conclude that prospects for sharing are minimal in the fixed and mobile bands below 500 MHz.[3] This conclusion is based on the perceived sacrosanct nature of existing users and the view that any shared use would have a devastating impact on existing systems operations. Moreover, those commenters who support this view also believe that the NVNG MSS should not have access to the 387-390 MHz. They indicate that such an allocation would be premature because they want the 380-399.9 MHz for their own services.

Obviously, there is a view that a fire wall must be established to save the private land mobile services from the NVNG MSS. This view defies the facts for a number of reasons. First, the NVNG MSS is a permissive service. It can only use spectrum that is not occupied. For instance, in the uplink band, FDMA systems seek open channels or the interstitial space between channels. If openings cannot be found for NVNG MSS channels, there will be no transmissions. Spectrum sharing between NVNG MSS uplinks and Land Mobile Radio Systems is a synergistic mix. It results in increased spectral efficiency without causing significant interference. Narrowband NVNG MSS systems use band scanning receivers and predictive algorithms to identify uplink band channels that will be clear and unused during the next uplink frame time. These channels are then assigned to NVNG MSS transceivers to use for uplink bursts. If the predictive algorithm is perfect, then the NVNG MSS transceiver transmissions will never cause interference into Land Mobile Radios.

Even if the algorithm makes a mistake, the probability of interference is still

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[3] See Comments of APCO, PCIA, Motorola, UTC and AAR.

small. For interference to occur the NVNG MSS transceiver would have to be located close to the Land Mobile Radio and operating on the same frequency it was using. Even if interference did occur, it would take the form of a "click" and the Land Mobile Radio operator would probably not be able to distinguish it from automotive noise. NVNG MSS transceivers typically transmit in frequent short bursts. It is highly unlikely that an individual Land Mobile Radio operator would experience more than one "click" per day from NVNG MSS transmissions.

As an example, assume that the predictive algorithm was poor and incorrectly assigned an active channel once every five seconds. Further assume that the satellite footprint has a radius of 2,000 km and that the separation distance required between a NVNG MSS transceiver and a Land Mobile Radio operating on the same frequency to prevent interference is 30 km. Then a given Land Mobile Radio will be in potential danger of receiving interference once every 6.2 hours.

For interference to actually occur, the given Land Mobile Radio would have to be operating on the same frequency assigned to the NVNG MSS transceiver. Assuming a 2 MHz bandwidth and 25 kHz Land Mobile Radio channels, then there are 80 possible channels and a given Land Mobile Radio will experience actual interference once every 20 days assuming it is turned on continuously. Assuming four hours per day usage results in an expected interval between interference events of four months.

With regard to CDMA systems, they operate at low enough power to be merely background noise to other users. However, if the noise created by fixed and mobile systems is too high, the CDMA NVNG MSS system cannot operate.

NVNG MSS proponents fully understand that they must seek bands where NVNG MSS systems and existing terrestrial systems can operate in a compatible manner. Moreover, NVNG MSS proponents understand that WRC-95 will not allocate frequency without any technical basis to support the allocation. In this regard, Leo One USA has been conducting its own analysis of the sharing potential in a range of possible bands for the NVNG MSS. The preliminary results of these studies appear in Appendix A and B to this Reply comment. The results show that Leo One USA can successfully operate its uplinks in land mobile bands in the 100 MHz to 500 MHz range and can co-exist with land mobile transceivers operating with a variety of channelization plans. A follow-on further refinement of this study will identify specific bands capable of supporting NVNG MSS systems in a shared environment. In this regard, Leo One USA is participating in the additional field studies being conducted by all the NVNG MSS proponents. Based on initial analysis, Leo One USA remains confident that frequencies can be identified and allocated by WRC-95 for the NVNG MSS.

III. Bands For Consideration For Allocation To the NVNG MSS

In its initial comments,[4] Leo One USA suggested several candidate bands for the NVNG MSS. There are several additional bands that Leo One USA believes could be considered. Specifically, at the recent meeting of the Inter-American Telecommunication Commission ("CITEL") several administrations indicated that they were looking at certain bands for the NVNG MSS. These include the 138-144 MHz

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[4] See Comments of Leo One USA Corporation at 8-12.

band which is being examined by Mexico and Venezuela, the 408-410 MHz band which is being examined by Canada, the 410-420 MHz band which is also being examined by Mexico, the 420-423 MHz band which is being examined by Canada and the 312-315 MHz and 387-390 MHz bands being examined by Mexico. Leo One USA believes that it would be highly desirable to develop proposals to WRC-95 in conjunction with other Region 2 administrations. In this regard, it would be worthwhile to see if the proposals of Canada, the U.S., Mexico and Venezuela can be aligned prior to WRC-95.

An additional option that was not raised in the initial comments is the possibility of dedicated allocations being made for NVNG MSS feeder links. It may be possible to allocate small bands of spectrum for feeder links if existing services were not high power and operations were in limited geographic areas. This type of allocation may increase the number of potential bands to be used for NVNG MSS and may alleviate some of the pressure on NVNG MSS service links.

Leo One USA is committed to participate in the development of empirical information necessary to support NVNG MSS allocations at WRC-95. It is confident that this information can be developed and looks forward to providing such information to the Commission in near future.[5]

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[5] In this regard, Leo One USA in conjunction with all the pending and licensed NVNG MSS systems are today seeking an extension of time of thirty days to submit supplemental reply comments in this proceeding. Leo One USA expects that technical information will be supplied in this additional reply to support allocation to the NVNG MSS.

CONCLUSION

For the reasons discussed above, Leo One USA urges the Commission to make proposals to WRC-95 for allocation of frequency to the NVNG MSS.

Respectfully submitted,

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Uplink Band

Interference Analysis Report

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LEO One USA Uplink Band Interference Analysis Report

1.0 Introduction and Summary

LEO One USA proposes to operate its subscriber uplinks in the 148.905 - 150.05 MHz band. Land Mobile transceivers operate in the 148 - 149.9 MHz band. Thus there is the potential for interference, both from Land Mobile Transceivers into LEO One USA satellites and from LEO One USA Transceivers into Land Mobile Transceivers. Other bands from 100 MHz to 500 MHz that are used by Land Mobile Transceivers are also being considered for "Little LEO" uplinks.

This report analyzes the interference potential in the 148 - 149.9 MHz band and determines the interference sensitivity to operation in other potential "Little LEO" bands. The results show that LEO One USA can successfully operate its uplinks in Land Mobile bands in the 100 MHz to 500 MHz range and can co-exist with Land Mobile Transceivers operating with a variety of channelization plans.

Section 2 provides the models used in this analysis. Interference from Land Mobile Transceiver transmitters into LEO One USA Satellite receivers is addressed in Section 3. Section 4 addresses interference from LEO One USA Transceiver transmitters into Land Mobile Transceiver receivers.

Section 3 shows that:

- The probability of finding 15 clear channels increases for smaller LEO One USA channel sizes for the same number of active Land Mobile Transceivers.
- For a given amount of spectrum, 1.9 MHz, the probabilities of finding 15 clear channels are similar for the 148 - 149.9 MHz, 312 - 315 MHz, and the 450 - 460 MHz bands for the same number of active Land Mobile Transceivers.
- The probability of finding 15 clear channels is significantly better for smaller Land Mobile Transceiver channels assuming the same number of active Transceivers.

Section 4 shows that:

- Operating in the interstitial channels significantly reduces interference for all of the data rates considered (9.6 kbps, 4.8 kbps, and 2.4 kbps).
- The lower the data rate, the smaller the potential interference distance.
- For the worst case of 15 active LEO USA Transceivers operating at 9.6 kbps at the Land Mobile Transceiver center frequencies, only 2.6% of the satellite footprint area is potentially effected. Operating at the interstitial frequencies reduces the area to less then 0.2%.
- The required separation distance for a given C/I threshold decreases with increasing frequency.

All of the results in Section 3 are a function of the number of <u>active</u> Land Mobile Transceivers in the satellite footprint. This is the number that are actually transmitting at a given instant of time. It is a function of the total number of Land Mobile

Transceivers in the footprint and the usage patterns. All of the results in Section 4 are a function of separation distance assuming that the Land Mobile Transceivers are operating at threshold. Additional work is required to evaluate the interference potential as a function of the Land Mobile Transceiver geographical distribution and usage patterns.

2.0 Models

The models used in this analysis are summarized in the following sections.

2.1 LEO One USA Satellite Receiver Model

- orbital altitude of 950 km
- 15° elevation mask angle
- circular polarized iso-flux antenna pattern
- G/T of -30.6 dB/°K at the sub-satellite point
- nominal 15 KHz channel bandwidth, alternate bandwidths of 5 KHz and 10 KHz
- center frequencies with 2.5 KHz spacing, i.e., 148.9075, 148.9100, 148.9125, 148.9150, 148.9175, ..., 149.8975 MHz.

2.2 LEO One USA Transceiver Transmitter Model

- 0 dBi vertically polarized antenna
- Three transmit waveform options (masks shown in Figure 2-1):

Data Rate	99% Power Containment Bandwidth	Transmit Power
9.6 kbps	8.2 KHz	7 W
4.8 kbps	4.1 KHz	3.5 W
2.4 kbps	2.05 KHz	1.75 W

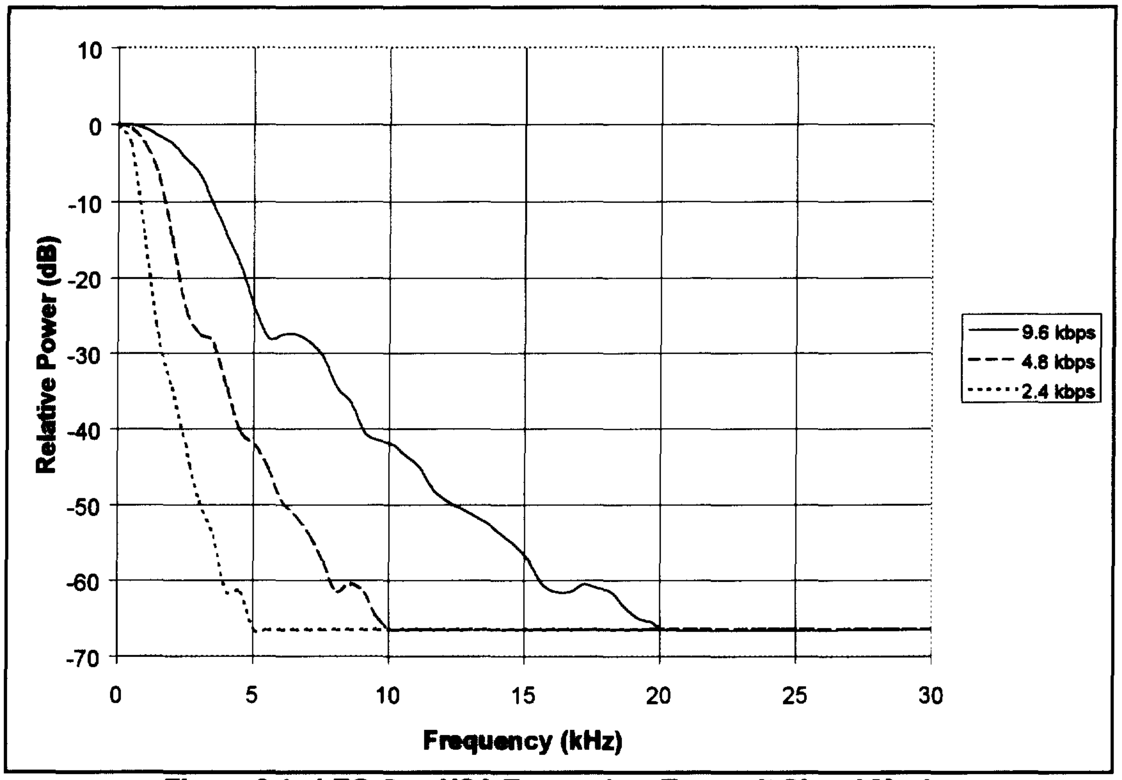

Figure 2-1. LEO One USA Transceiver Transmit Signal Masks

2.3 Land Mobile Transceiver Model

- uniformly distributed within the satellite footprint, i.e., probability proportional to distance from sub-satellite point and independent of azimuth angle
- uniformly distributed center frequencies assuming 25 KHz Grid, i.e., center frequencies of 148.9125, 148.9375, 148.9625, ..., 149.8875 MHz
- 14 dBW transmit power
- 6 dBi vertically polarized antenna (assume 0 dBi in direction of satellite)
- typical 25 KHz FM land-mobile radio signal with 16 KHz signal bandwidth (5 KHz peak frequency deviation and 3 KHz modulation bandwidth) and alternate 8 KHz FM signal, masks shown in Figure 2-2.
- 16 KHz IF receive bandwidth, alternate 8 KHz
- -140 dBW minimum received signal power (sensitivity)
- Doppler distributions at 149 MHz shown in Figure 2-3.

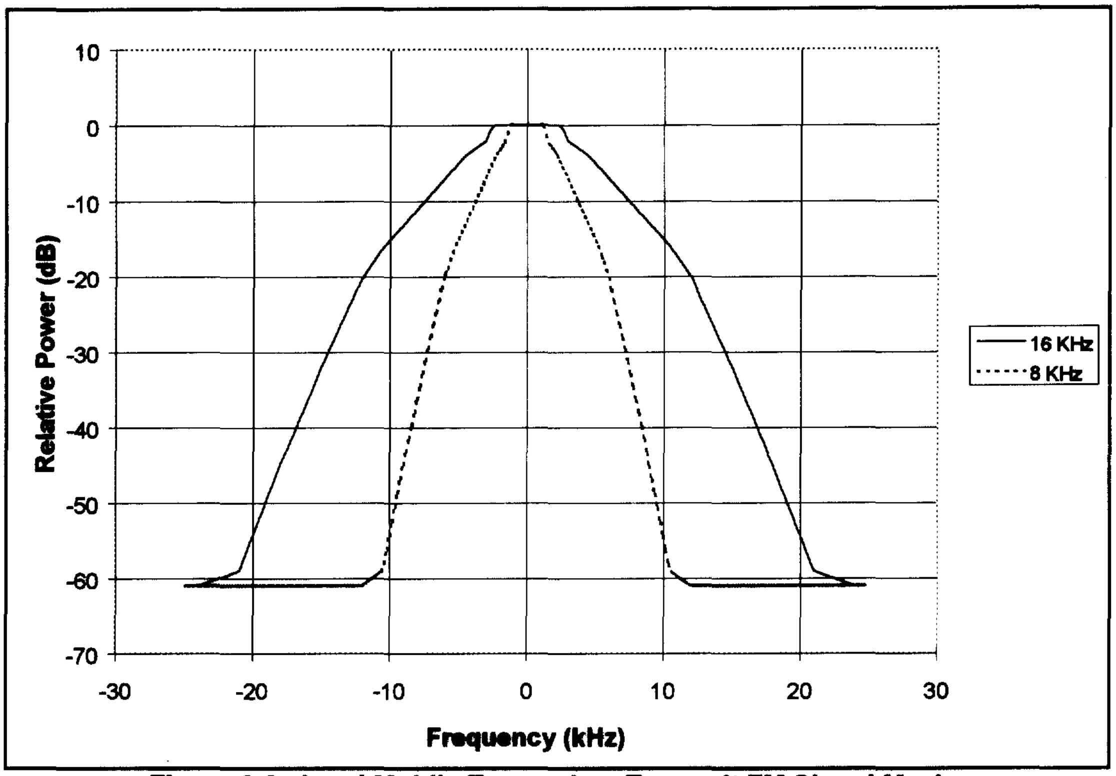

Figure 2-2. Land Mobile Transceiver Transmit FM Signal Masks

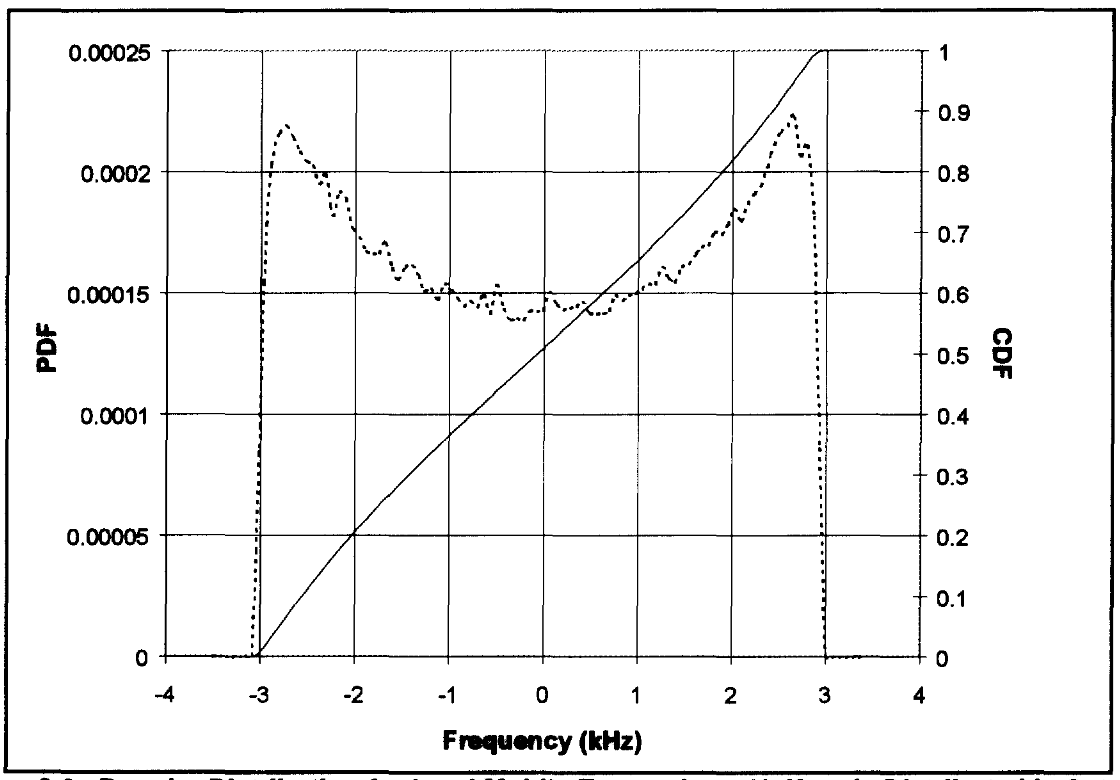

Figure 2-3. Doppler Distribution for Land Mobile Transceivers Uniformly Distributed in Satellite Footprint

3.0 Interference from Land Mobile Transceivers into LEO One USA Satellites

Simulations were performed for a number, N, of active Land Mobile Transceivers from 5 to 200 in steps of 5. For each N, 1,000 simulation steps were performed. At each step, N Land Mobile Transceivers were randomly placed within the satellite footprint and randomly selected transmit channels for each transceiver were used. The interference power at the satellite was computed for each of the 2.5 KHz center frequencies taking account of the Doppler effect. The received interference power density relative to receiver noise power density is given by:

$$I_0/N_0 = EIRP_0\ (dBW/Hz) - k\ (dBW/Hz/^\circ K) - FSL\ (dB) + G/T\ (dB/^\circ K).$$

Since the iso-flux satellite antenna compensates for slant range variation, the equation reduces to:

$$I_0/N_0\ (dB) = EIRP_0\ (dBW/Hz) - [-62.5\ (dBW/Hz)].$$

where $EIRP_0$ is the EIRP density (W/Hz).

The number of clear channels were determined for each of the possible LEO One USA channel bandwidths (5 KHz, 10 KHz, and 15 KHz) and for three I_0/N_0 thresholds (0 dB, 10 dB, and 20 dB).

Figures 3-1 through 3-13 assume that 1.9 MHz of spectrum is used and compare available channels for three different I_0/N_0 thresholds (0 dB, 10 dB, and 20 dB). The 0 dB threshold corresponds to a 3 dB reduction in link margin, the 10 dB threshold to a 10.4 dB reduction, and the 20 dB threshold to a 20 dB reduction. A Land Mobile channelization plan with 25 KHz spacing (grid) and 16 KHz FM signals is assumed. Figures 3-1 through 3-10 assume the 148 - 149.9 MHz band.

Figures 3-1, 3-2, and 3-3 show the median number of clear channels as a function of the number of active Land Mobile Transceivers in the satellite footprint for 5 KHz, 10 KHz, and 15 KHz LEO One USA channels, respectively. Figures 3-4, 3-5, and 3-6 show the 90-th percentile number of clear channels. The results are similar for all three interference thresholds.

The number of active Land Mobile Transceivers in the satellite footprint is the number that are actually transmitting at a given instant of time. The active number is a function of the total number of Land Mobile Transceivers in the footprint and the usage patterns.

Figures 3-7, 3-8, and 3-9, show the probability of 15 clear channels being available as a function of the number of active Land Mobile Transceivers in the satellite footprint for 5 KHz, 10 KHz, and 15 KHz LEO One USA channels, respectively. Again the results are similar for the three different thresholds. The increase in the number of active Land Mobile Transceivers that reduces the probability of 15 clear channels from 90% down to 10% is relatively small, especially for the larger channel bandwidths.

Figure 3-10 shows the probability of 15 clear channels ($I_0/N_0 < 10$ dB) being available as a function of the number of active Land Mobile Transceivers in the satellite footprint for 5 KHz, 10 KHz, and 15 KHz LEO One USA uplink channel bandwidths. The probabilities increase as the LEO One USA channel bandwidth decreases.

Figures 3-11, 3-12, and 3-13, show the probability of 15 clear channels ($I_0/N_0 < 10$ dB) being available as a function of the number of active Land Mobile Transceivers in the satellite footprint assuming 1.9 MHz of spectrum is used at each of three center frequencies (149 MHz, 313.5 MHz, and 455 MHz) and for 5 KHz, 10 KHz, and 15 KHz LEO One USA uplink channel bandwidths, respectively. These figures show that the probabilities are similar for all of the bands.

Figures 3-14 through 3-22 assume that 1 MHz of spectrum (149.000 MHz to 150.000 MHz) is used and compare available channels for four different Land Mobile Transceiver channelization plans. The four channel spacings (grids) are 12.5 KHz, 15 KHz, 25 KHz, and 30 KHz. For the 12.5 KHz and the 15 KHz grids a 8 KHz IF bandwidth FM signal is assumed and for the 25 KHz and the 30 KHz grids a 16 KHz IF bandwidth FM signal is assumed. The center frequencies used for the Land Mobile channels are:

Grid	Center Frequencies
12.5 KHz	149.00625 MHz, 149.01875 MHz, ..., 149.99375 MHz
15 KHz	149.0075 MHz, 149.0225 MHz, ..., 149.9825 MHz
25 KHz	149.0125 MHz, 149.0375 MHz, ..., 149.9875 MHz
30 KHz	149.015 MHz, 149.045 MHz, ..., 149.975 MHz

Figures 3-14, 3-15, and 3-16 show the median number of clear channels ($I_0/N_0 < 10$ dB) as a function of the number of active Land Mobile Transceivers in the satellite footprint for each of the four channelization plans and for 5 KHz, 10 KHz, and 15 KHz LEO One USA channels, respectively. Figures 3-17, 3-18, and 3-19 show the 90-th percentile number of clear channels. The results for the 12.5 KHz and the 15 KHz grids are similar, also for the 25 KHz and the 30 KHz grids.

Figures 3-20, 3-21, and 3-22, show the probability of 15 clear channels being available as a function of the number of active Land Mobile Transceivers in the satellite footprint for each of the four channelization plans and for 5 KHz, 10 KHz, and 15 KHz LEO One USA channels, respectively. The probability of 15 clear channels is significantly better for the 8 KHz FM plans compared to the 16 KHz FM plans.

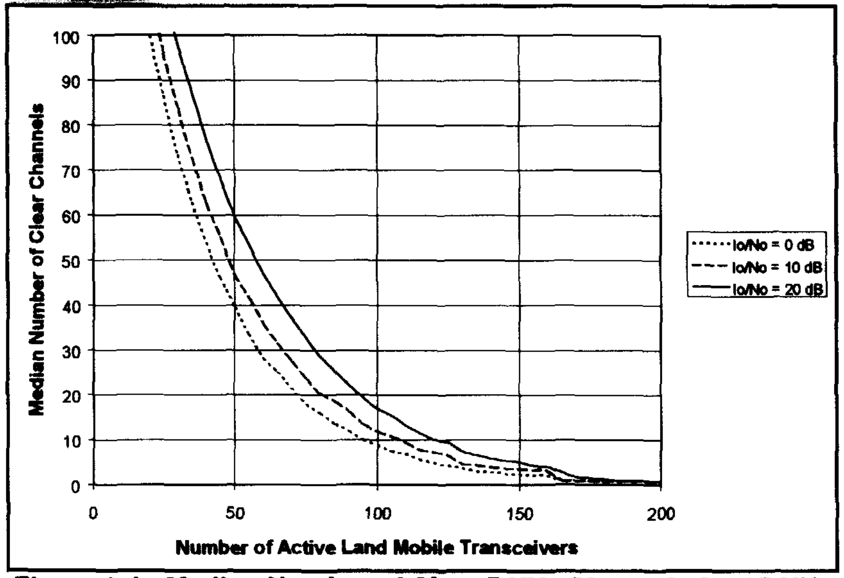

Figure 3-1. Median Number of Clear 5 KHz Channels for 25 KHz Land Mobile Grid

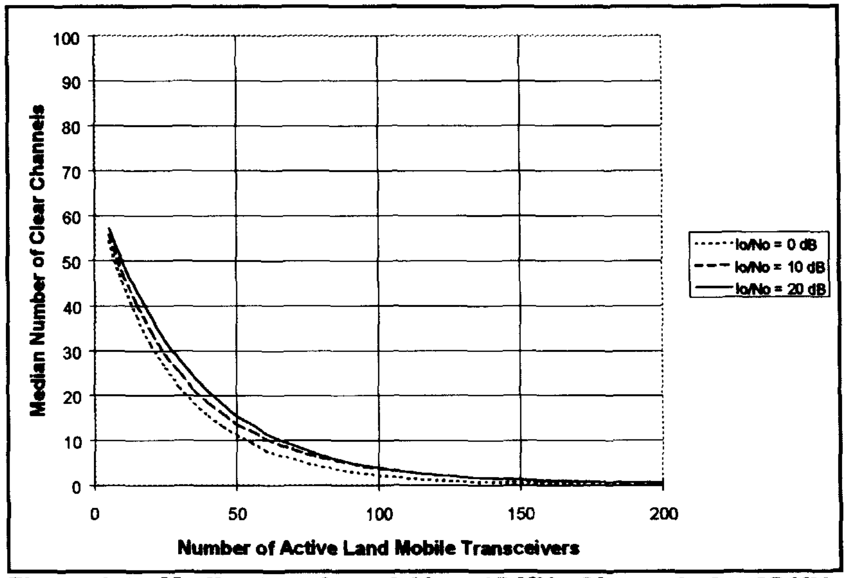

Figure 3-3. Median Number of Clear 15 KHz Channels for 25 KHz Land Mobile Grid

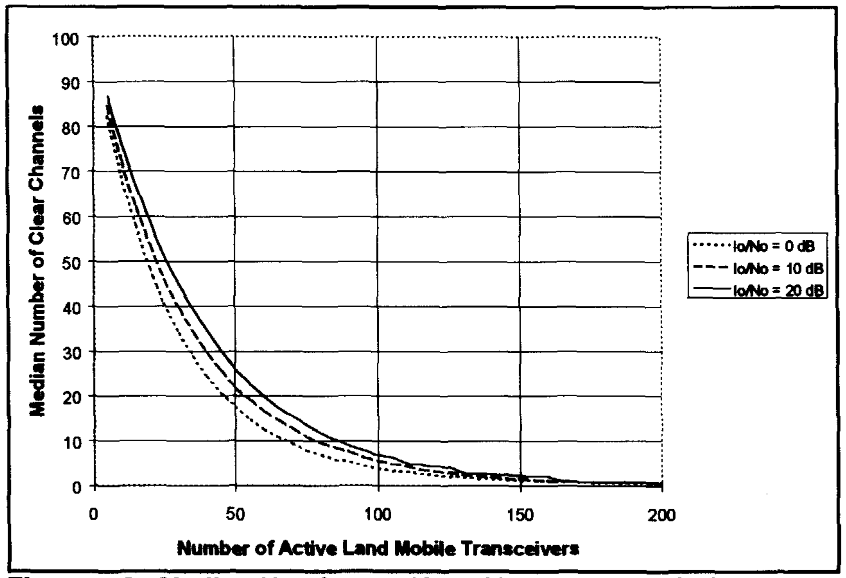

Figure 3-2. Median Number of Clear 10 KHz Channels for 25 KHz Land Mobile Grid

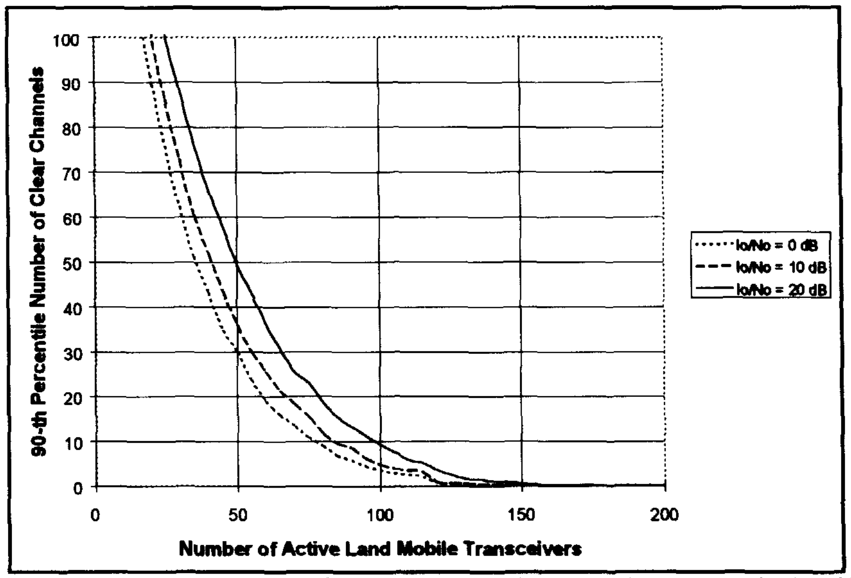

Figure 3-4. 90-th Percentile Number of Clear 5 KHz Channels for 25 KHz Land Mobile Grid

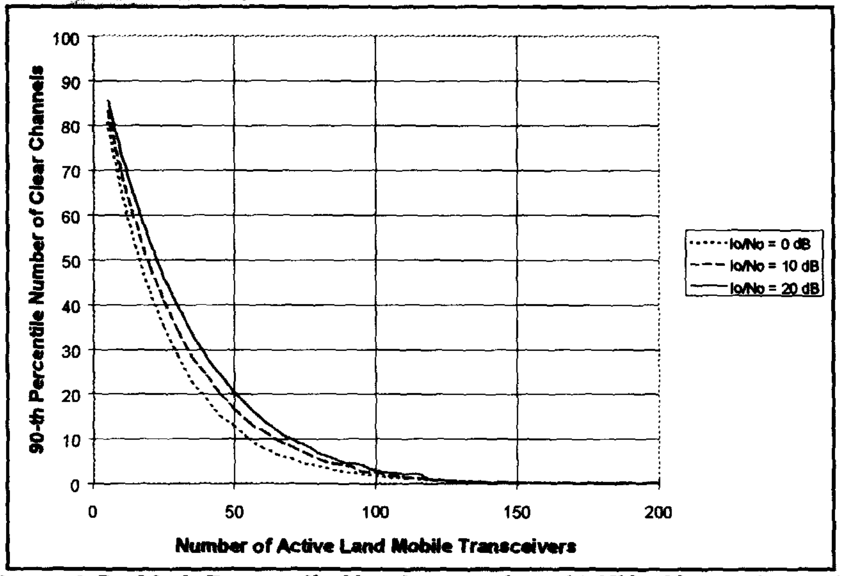

Figure 3-5. 90-th Percentile Number of Clear 10 KHz Channels for 25 KHz Land Mobile Grid

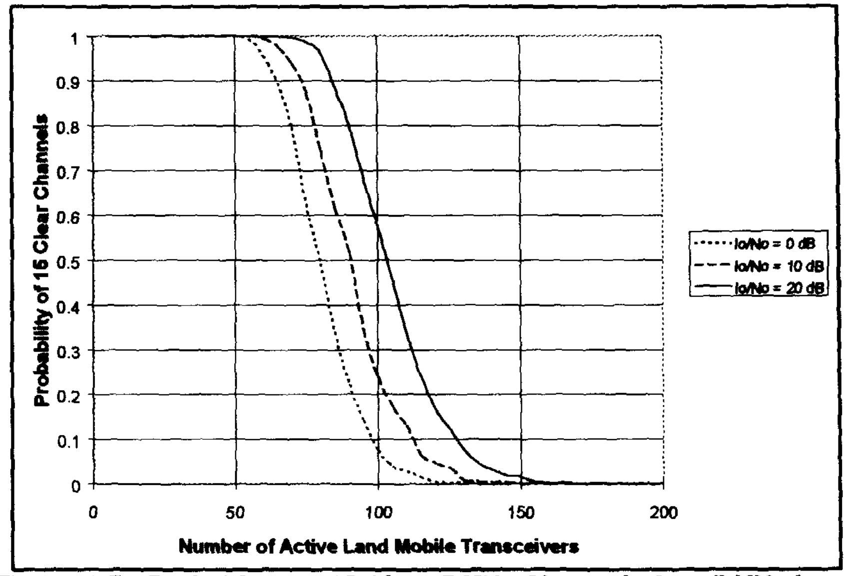

Figure 3-7. Probability of 15 Clear 5 KHz Channels for 25 KHz Land Mobile Grid

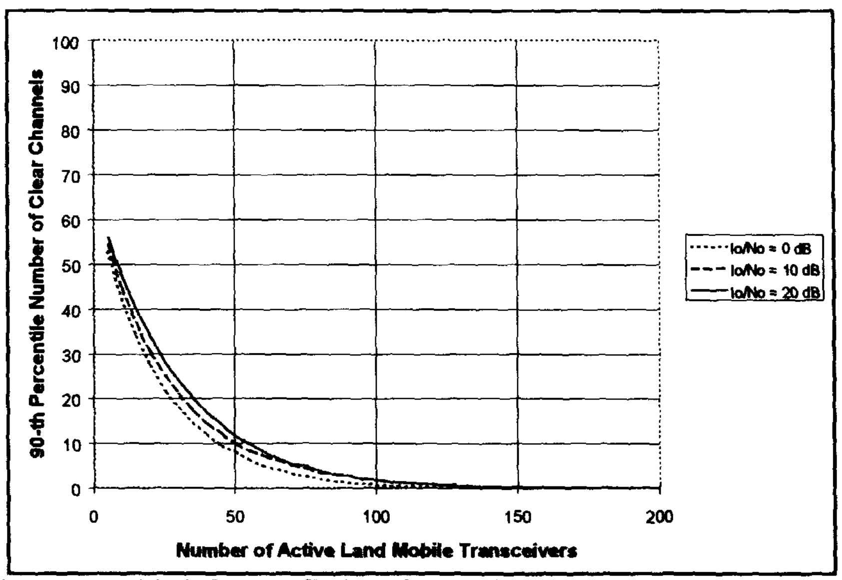

Figure 3-6. 90-th Percentile Number of Clear 15 KHz Channels for 25 KHz Land Mobile Grid

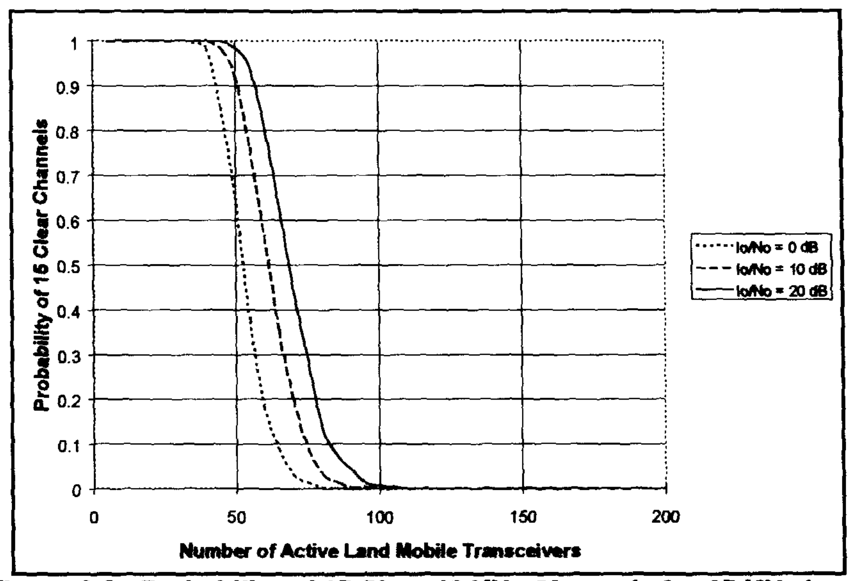

Figure 3-8. Probability of 15 Clear 10 KHz Channels for 25 KHz Land Mobile Grid

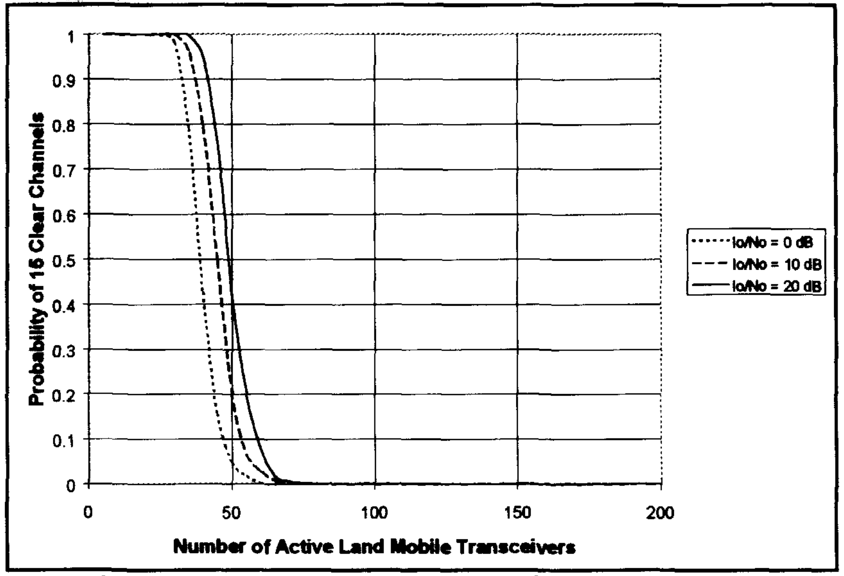

Figure 3-9. Probability of 15 Clear 15 KHz Channels for 25 KHz Land Mobile Grid

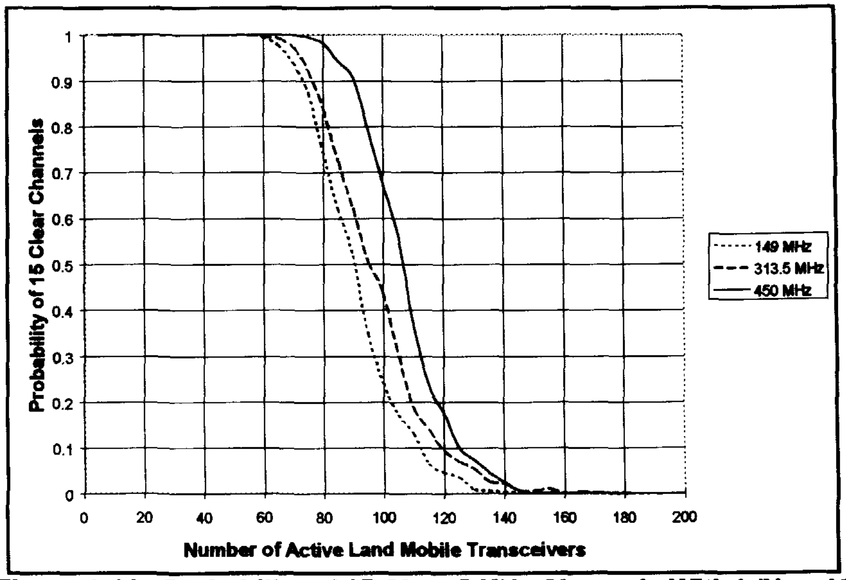

Figure 3-11. Probability of 15 Clear 5 KHz Channels With $I_0/N_0 < 10$ dB for 25 KHz Land Mobile Grid

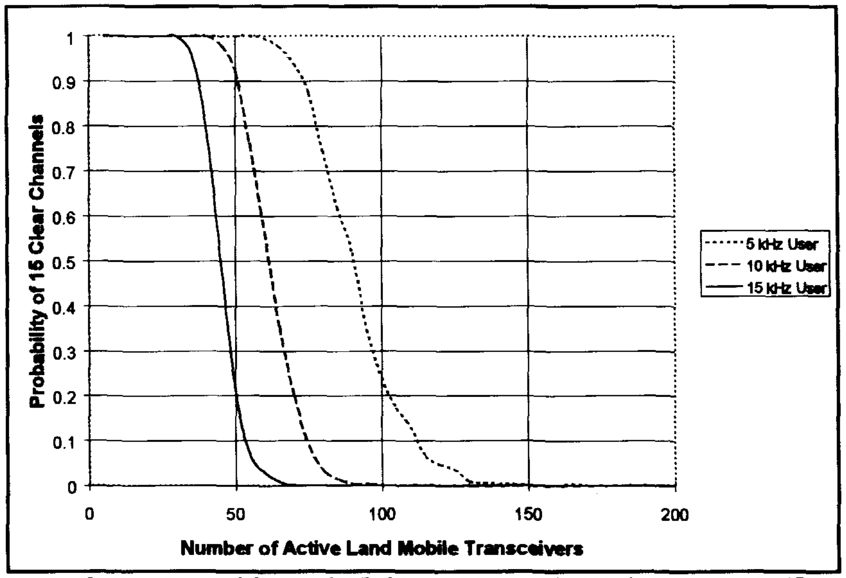

Figure 3-10. Probability of 15 Clear Channels With $I_0/N_0 < 10$ dB for 25 KHz Land Mobile Grid

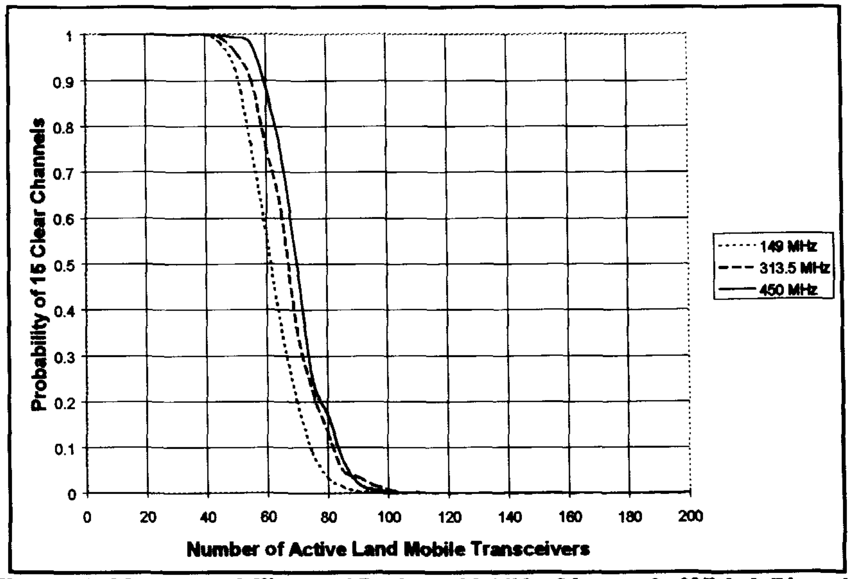

Figure 3-12. Probability of 15 Clear 10 KHz Channels With $I_0/N_0 < 10$ dB for 25 KHz Land Mobile Grid

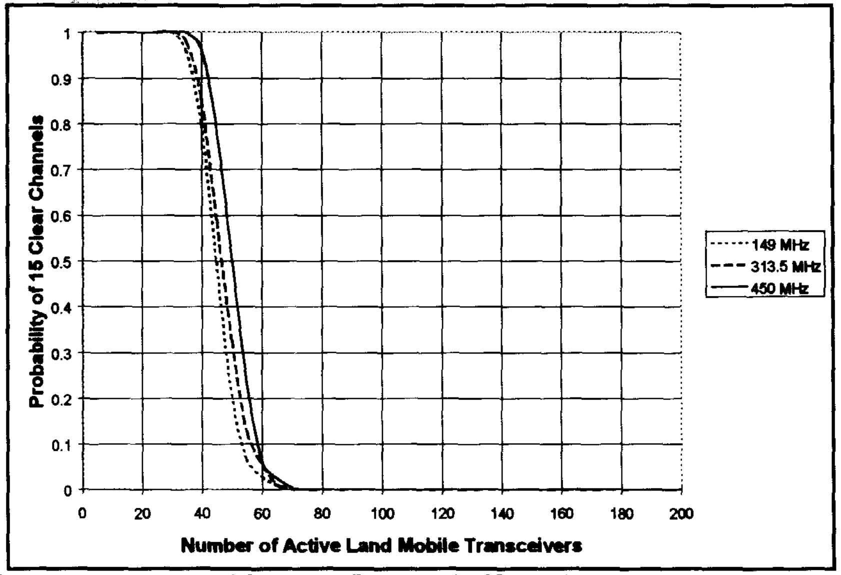

Figure 3-13. Probability of 15 Clear 15 KHz Channels With $I_0/N_0 < 10$ dB for 25 KHz Land Mobile Grid

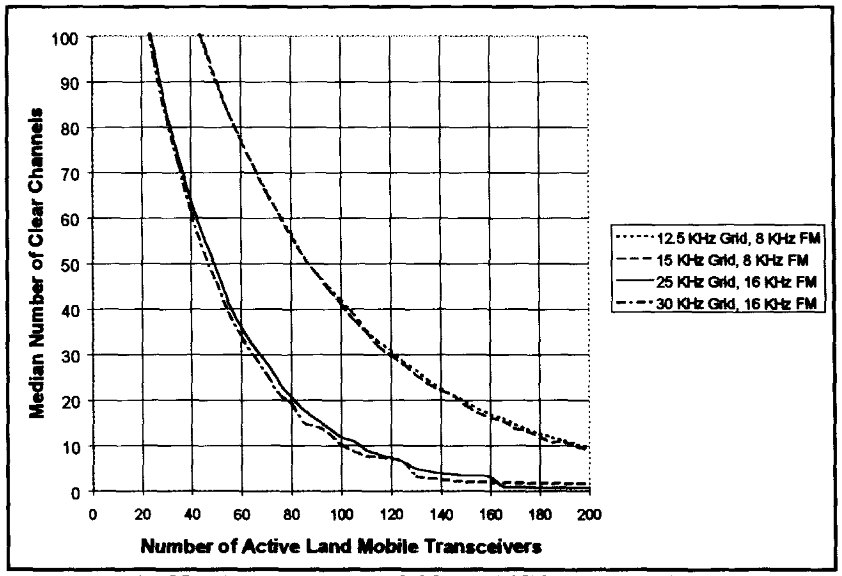

Figure 3-14. Median Number of Clear 5 KHz Channels for Various Land Mobile Configurations

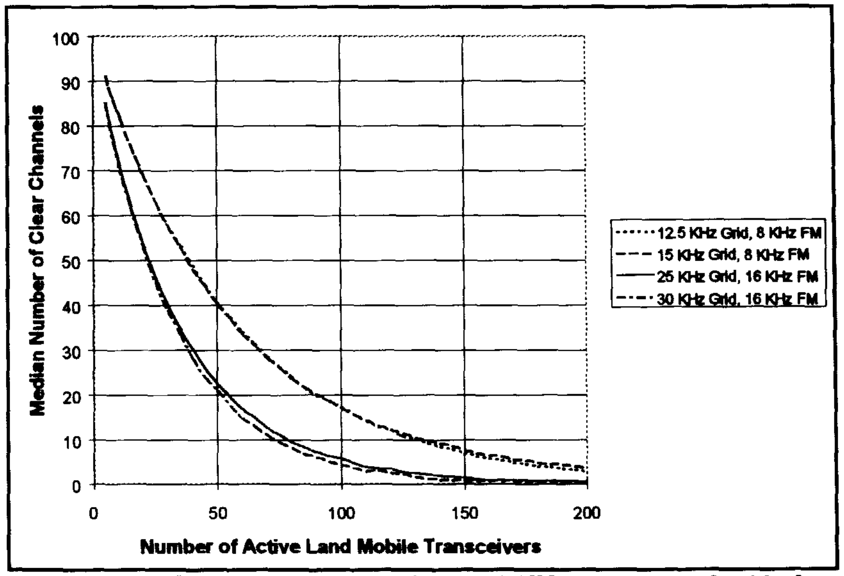

Figure 3-15. Median Number of Clear 10 KHz Channels for Various Land Mobile Configurations

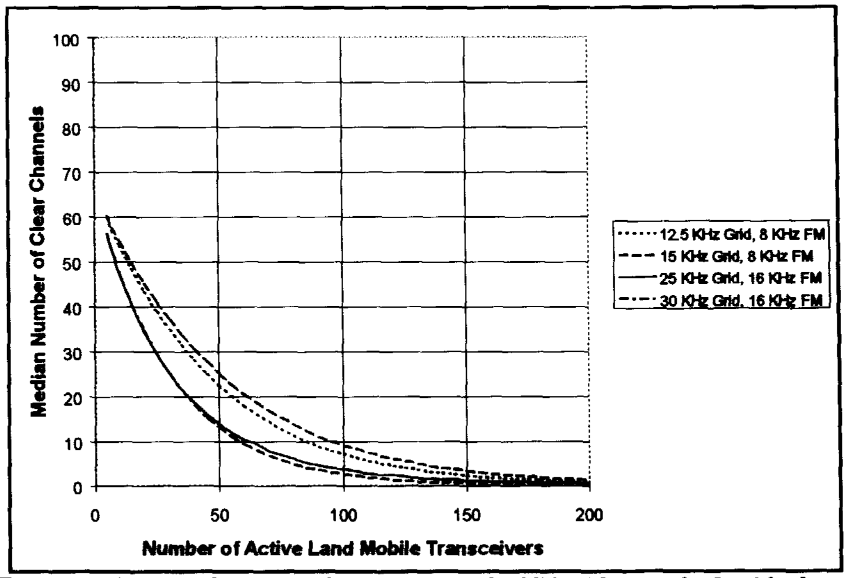

Figure 3-16. Median Number of Clear 15 KHz Channels for Various Land Mobile Configurations

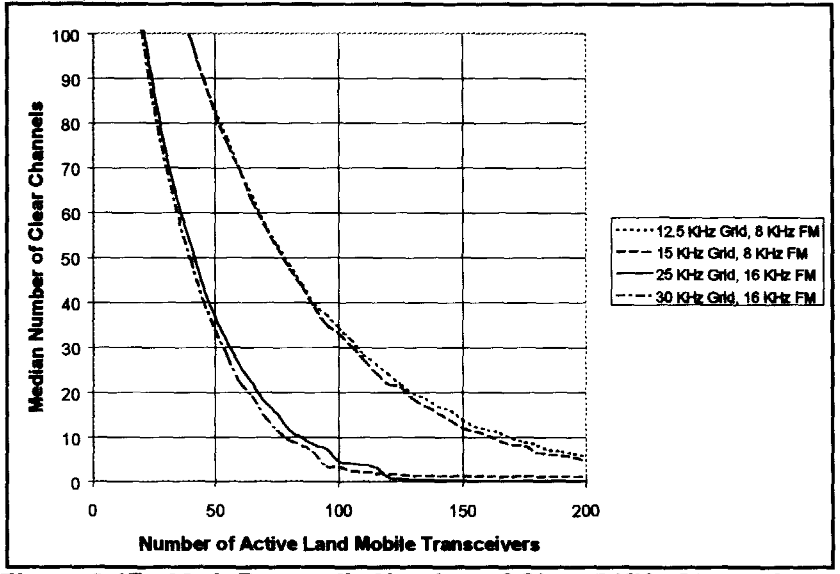

Figure 3-17. 90-th Percentile Number of Clear 5 KHz Channels for Various Land Mobile Configurations

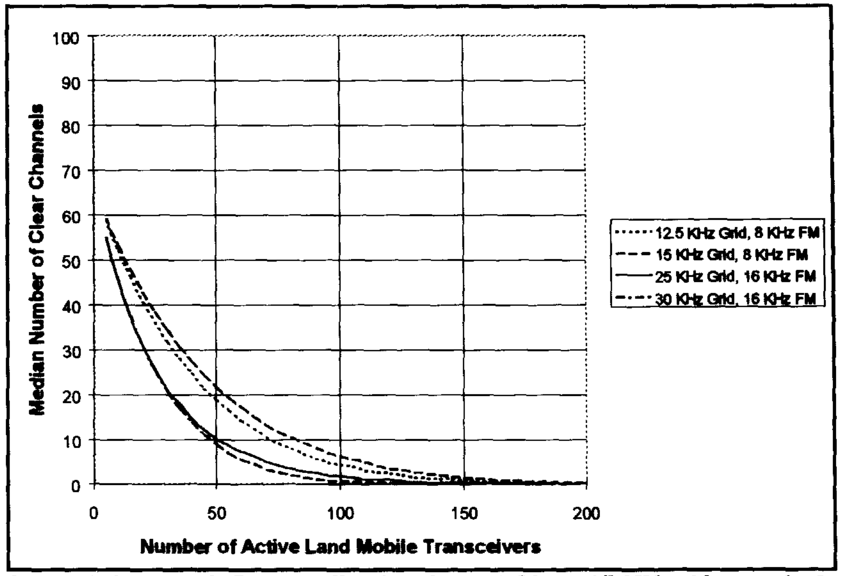

Figure 3-19. 90-th Percentile Number of Clear 15 KHz Channels for Various Land Mobile Configurations

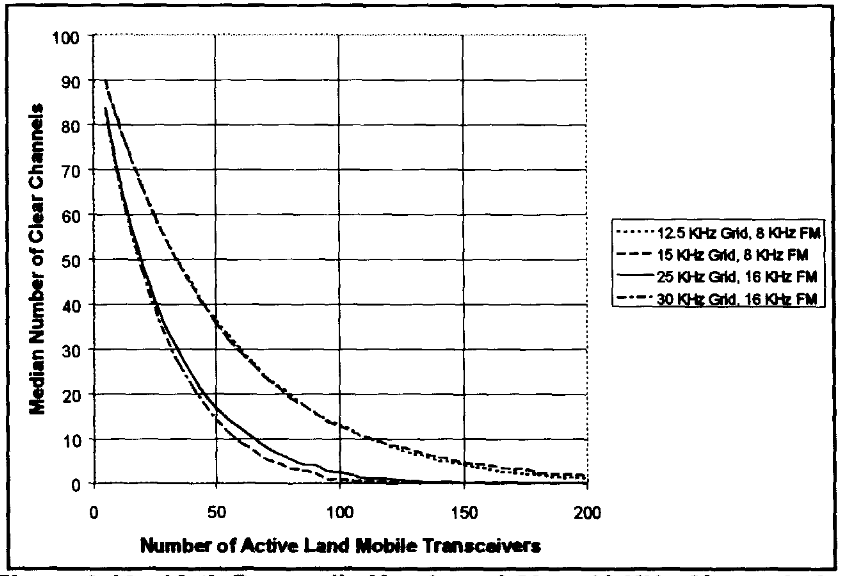

Figure 3-18. 90-th Percentile Number of Clear 10 KHz Channels for Various Land Mobile Configurations

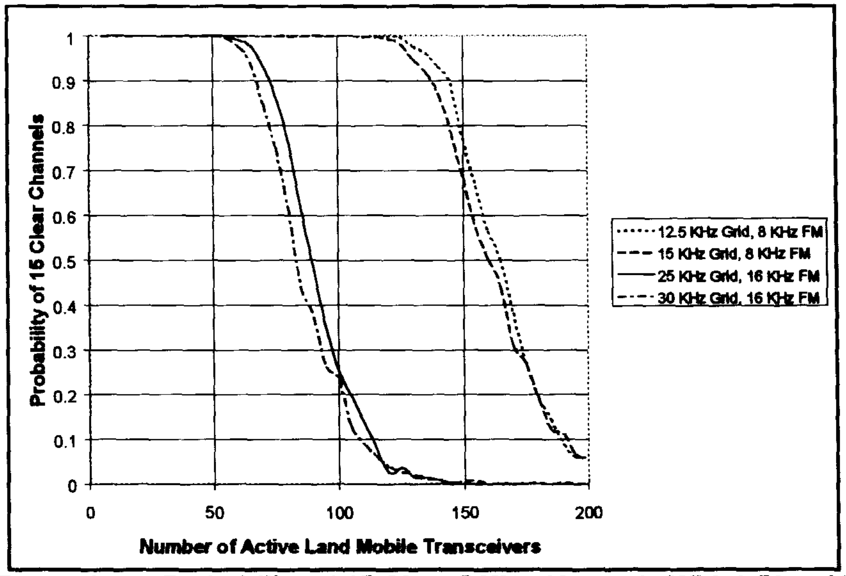

Figure 3-20. Probability of 15 Clear 5 KHz Channels With $I_0/N_0 < 10$ dB for Various Land Mobile Plans

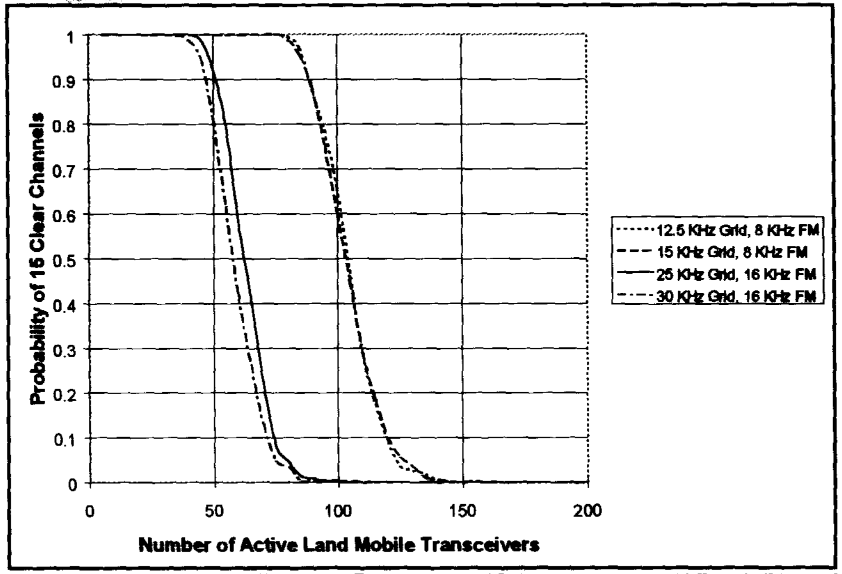

Figure 3-21. Probability of 15 Clear 10 KHz Channels With $I_0/N_0 < 10$ dB for Various Land Mobile Plans

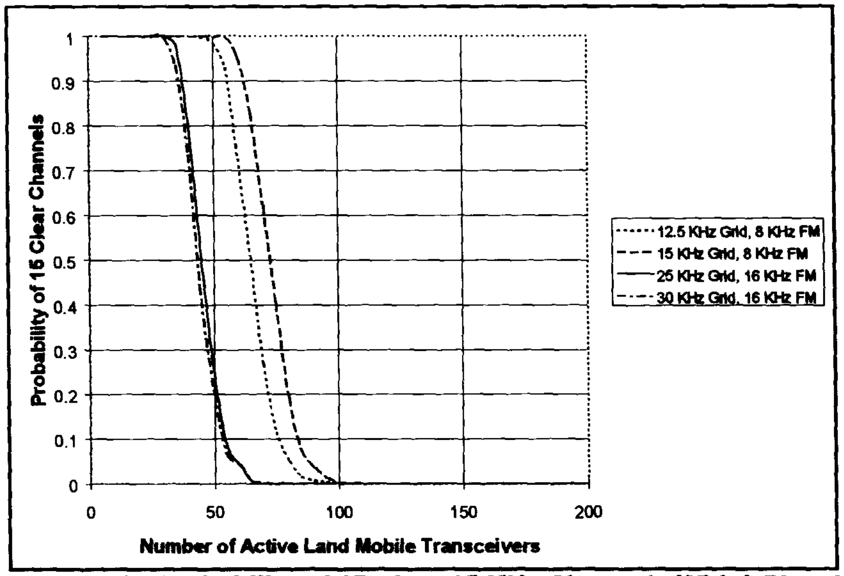

Figure 3-22. Probability of 15 Clear 15 KHz Channels With $I_0/N_0 < 10$ dB for Various Land Mobile Plans

4.0 Interference from LEO One USA Transceivers into Land Mobile Transceivers

The interference power flux density at the Land Mobile Transceiver is calculated using the equations in ITU-R M.1039 with an antenna height product of 10 m. The received interference power density prior to the IF filter is given by:

$$I_0^{\text{pre-filter}}\ (\text{dBW/Hz}) = 28.15\ (\text{dB}) + EIRP_0\ (\text{dBW/Hz}) - 40 \cdot \log[d]$$

where $EIRP_0$ is the transmit EIRP density (W/Hz)
d is the separation distance in meters.

All of the figures assume that the Land Mobile Transceiver is operating at threshold, thus the results are worst case. Threshold operation is the exception not the rule. Figures 4-1 through 4-10 assume a Land Mobile Transceiver IF bandwidth of 16 KHz. Figures 4-1 through 4-6 assume an operating frequency of 149 MHz.

Figures 4-1, 4-2, and 4-3 show the carrier-to-interference power ratio (C/I) in the Land Mobile Transceiver IF bandwidth as a function of separation distance between the LEO One USA Transceiver and the Land Mobile Transceiver for various center frequency offsets and for LEO One USA data rates of 9.6, 4.8, and 2.4 kbps, respectively. For all three data rates the 0 and 6.25 KHz offsets result in the same interference. Also, for all of the data rates the 12.5 KHz, interstitial, offset results in a significant reduction in interference.

Figure 4-4 compares the C/I for the three data rates for a 12.5 KHz offset. The lower data rates are seen to result in less interference. Assuming a 20 dB C/I threshold, the interference distances are 19 km, 7 km, and 3 km, for the 9.6, 4.8, and 2.4 kbps data rates, respectively.

Figure 4-5 shows the percentage area of the LEO One USA satellite footprint where Land Mobile Transceivers may potentially experience interference (C/I < 20 dB) when 15 LEO One USA Transceivers are active in the footprint simultaneously as a function of frequency offset for the three data rates. In the worst case, 9.6 kbps LEO One USA data rates and 0 KHz frequency offset, only 2.6% of the footprint area is potentially effected. Operation at the 12.5 KHz, interstitial, offset reduces the potentially impacted area by a factor of 15.

Figure 4-6 shows the percentage area of the LEO One USA satellite footprint where Land Mobile Transceivers may potentially experience interference (C/I < 20 dB) as a function the number of active LEO One USA Transceivers for 0 and 12.5 KHz offsets. The 12.5 KHz, interstitial, offset results in a significant reduction in interference potential.

Figures 4-7, 4-8, and 4-9 show the C/I in the Land Mobile Transceiver IF bandwidth as a function of separation distance and for three potential uplink frequencies (149 MHz, 313.5 MHz, and 455 MHz) and for LEO One USA data rates of 9.6, 4.8, and 2.4 kbps, respectively. It is seen that the required separation distance for a given C/I threshold decreases with increasing frequency.

Figure 4-10 shows the percentage area of the LEO One USA satellite footprint where Land Mobile Transceivers may potentially experience interference (C/I < 20 dB) as function of frequency for 15 active 9.6 kbps LEO One USA Transceivers for 0 and 12.5 KHz offsets. The area of the footprint that is potentially impacted decreases with increasing frequency and is almost negligible for interstitial operation (12.5 KHz offset).

Figures 4-11 through 4-16 are similar to Figures 4-1 through 4-6, respectively, with a Land Mobile Transceiver IF bandwidth of 8 KHz, and frequency offsets of 0, 6.25, and 12.5 KHz. The results are similar to the 16 KHz IF bandwidth results above.

Figures 4-11, 4-12, and 4-13 show C/I in the Land Mobile Transceiver IF bandwidth as a function of separation distance and for LEO One USA data rates of 9.6, 4.8, and 2.4 kbps, respectively. Figure 4-14 compares the C/I for the three data rates for a 6.25 KHz offset.

Figure 4-15 shows the percentage area of the LEO One USA satellite footprint where Land Mobile Transceivers may potentially experience interference (C/I < 20 dB) when 15 LEO One USA Transceivers are active in the footprint simultaneously as a function of frequency offset for the three data rates.

Figure 4-16 shows the percentage area of the LEO One USA satellite footprint where Land Mobile Transceivers may potentially experience interference (C/I < 20 dB) as a function the number of active LEO One USA Transceivers for 0 and 6.25 KHz offsets.